

Altimetric Observation of the Global Oceans: Advancement in Oceanography Enabled by Space Geodesy

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The prospects of using spaceborne radar altimeter to measure the height of the sea surface for studying the dynamics of the global ocean circulation were realized long time ago in the late sixties. However, the daunting requirement of measurement accuracy at centimeter level had made the prospects remain a dream for a long time. In addition to the difficulties of making precise determination of the range of the radar with respect to the rough seas through the highly variable intervening atmosphere, the challenge of knowing the exact location of the spacecraft hundreds of kilometers above the earth was overwhelming. Owing to a series of development in space geodesy such as improved gravity models, advancement in precision satellite tracking, techniques to fix the coordinates of tracking stations, as well as modeling and algorithm developments, the capability of precision orbit determination (POD) has progressed by three orders of magnitudes in the past 30 years, with accuracy evolved from 20 meters to 2 cm. Among other factors, the advancement in POD has led to the success of precision altimetric missions such as TOPEX/POSEIDON. The data from the mission have provided an opportunity to study the dynamics of global ocean circulation and tides with an unprecedented coverage and accuracy. Discoveries range from this century's largest El Niño and its associated global sea level change, the speed of planetary waves, to the role of tidal friction in oceanic mixing. A brief overview of these results will be presented. The challenges of future development will also be addressed.